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Strategies and policies from promoting the use of renewable energy resource in the UAE

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ABSTRACT

This paper looks into developing energy policy in the UAE in order to prompt renewable energy practices and thus sustainability in the UAE. This includes analyzing current and proposed future energy policies in the UAE. The research analyzed a wide range of strategies used in different countries in order to assess the best practice examples, while remaining mindful of the particularities of each country. Based on these lessons a strategy for promoting renewable energy in the UAE was formulated. The proposed strategy is composed of short, medium and long term policies. The proposed strategy was submitted to and discussed with relevant authorities and stakeholders in the UAE. Based on the feedback from the stakeholders the proposed policy was further refined. The main components of the final strategy include deregulation at three different levels (emirate, country and the gulf region), open access to the grid as well as financial incentives, e.g. implementation of a Feed-in Tariff. The final strategy is included at the end of the paper.

Contents

1. Introduction

The use of renewable energy sources (RES) is nothing new. Humans have used hydropower, solar thermal, geothermal and wind energy for thousands of years. This remained the case until the industrial age when the combination of the steam engine and fossil based fuels (coal and oil) all but eclipsed the use of RES. The resurgence of RES use was first brought to the spotlight in late 1973 as a result of the oil crises of 1973–1980 [1]. During the 1970s and early 1980s saw a large increase in research and government funded projects designed to develop and commercialize RES. But in the mid-1980s oil prices plummeted causing the enthusiasm and funding of RES to dwindle. Low oil prices continued until the end of the 1990s. The next RES impetus came as a result of increased recognition of the global warming phenomenon and the role of fossil fuels in it due to high emissions of Greenhouse Gases (GHGs) during the combustion of fossil fuels, mainly CO_2.

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However, one of the reasons for late start up of RES is the technologic advance, mainly in PV, as for the wind energy the materials and machine efficiency and performs were one of the barriers for the late start up of RES.

RE has been used for a long time ago and it existed before fossil fuels were discovered. The main expansion in the RE's came as a result of the oil crises of 1973–1980 [1]. Though RE was known a long time ago, it got an unexpected raise following the 1973 oil shock [2]. This change emerged from the rapid development that causes high emissions of Greenhouse Gases (GHGs) owing to the combustion of fossil fuels. Serious problems emerged from this change are seen in the form of frequent droughts as well as floods. Additionally, this change has resulted in climate change which made the planet warmer and therefore reduced land area due to flooding of coastal regions or due to drought of water sources [3]. Action is needed and is required to achieve a low-carbon global energy system, because the current CO_2 emission will lead to serious effects to the atmosphere. It is essential to expand the RE supplies and to use the energy in a more efficient way. In 2002, the consumption of the worldwide coal, gas and oil were 78% of the primary energy consumption; the combustion of fossil fuel has been the main source of CO_2 emissions because this combustion is growing at the rate of 0.5% per year [1]. This urgency has been recently highlighted by Olabi [4].

From the above information and considering the discussions and analysis, it is obvious that only few of today's technologies will survive in the 21st century because of the limited quantities of conventional energy reserves. This fact is an alarm to start using RE before the conventional energy reserves run out. There are serious concerns for humanity related to environmental damage as well as issues related to geopolitical tension due to the continuation of the fossil fuel intensive energy economy. Therefore, reliance on clean renewable energy is very desirable and necessary [5]. Furthermore, several scenarios have been considered by the Intergovernmental Panel on Climate Change (IPCC) in the fourth assessment report. One of the scenarios is that the concentration of GHGs can be stabilized to limit the temperature increase at equilibrium of 2.0–2.4 Co. This can be achieved by a reduction of 50–85% in the current level of GHG emission which is required by 2050 [2].

The UK RE Advisory Group (REAG) defined RE as the term used to cover 'those energy flows that occur naturally and repeatedly in the environment, and can be used for human benefit' [2]. RE sources are based on the natural and interconnected flows of energy for our planet. Main RE resources for electrical power generation can be categorized as follows: solar thermal energy, wind, solar PV, hydro, geothermal and biomass [4]. In addition, RE sources also have important applications for energy storage and conversion, especially in heating, ventilation, air conditioning, and refrigeration (HVAC and R) industry [30–33]. RE sources are safe, secure and scalable and moreover can improve the well-being of a society. RE offers, clean, safe, local and increasingly cost-effective options for all our energy needs. Moreover, it has the lowest environmental effect of all energy sources; it is also a local and a natural resource. Thus it offers enormous scope for achieving energy security. RE does not cause any environmental hazards such as acid rain and greenhouse warming. RE is called a green supply while the conventional energy is called as a brown supply. Moreover, RE is safe and does not cause any harm to the environment, whereas the conventional energy pollutes air and water. Furthermore, the lifetime of the green energy is infinite but the conventional energy is limited. Today, most of the RE sources are more expensive than the corresponding fossil-fuel and nuclear sources. The financial subsidies are given to RE's through either pay-as-you-go financing as in the case of electric power or targeted subsidies as in the market launch program of the German Federal government for the area of renewable heating sources [29].

The UAE is considered to be the world's sixth largest proven oil reserves and the fifth largest natural gas reserve. This makes the UAE a critical supplier in the global energy markets. Additionally, the UAE is considered to be the world's third largest exporter of crude oil. The UAE is an important oil and natural gas producer; moreover, it is a member of the Organization of the Petroleum Exporting Countries (OPEC). Currently the UAE has not officially adopted the use of renewable power, where priority has been focused on traditional ways to generate electricity rather than on renewable directions, although the country has some good RE resources such as solar power which could help in improving sustainability. In the UAE the need for effective RE policy-making is becoming important due to political aspects that recommend using different resources to produce energy. It is very important to set a clean development mechanism and to establish a RE industry. There is a need for consistent and stable policies and a true integration of RE resources and energy efficiency into energy system planning. In the meantime, the UAE is taking giant steps forward to RE and energy efficiency programs.

Sustainability and the use of RE is prominent in the strategic plans of both AD and Dubai in terms of targets that need to be achieved in terms of RE contribution to the overall energy sector. Still there are many obstacles most important of which is the lack of policies and regulations that promote the use of RE in the UAE. It is important to note here that although AD and Dubai are two of the seven emirates that makeup the UAE the UAE is actually a federation of seven emirates as follows:

- Abu Dhabi;
- Dubai;
- Sharjah;
- Ajman;
- Um-AlQuwain;
- Ras-AlKhaimah; and
- AlFujairah

Each has its own rules and regulations. Energy policy is determined at the emirate level rather than the federal level which further hinders the push for RE in the UAE. The focus of this paper is to identify the challenges of adopting RE in the UAE and to propose a range of policies in order to overcome these challenges. The proposed strategies will be based on the experiences of other countries in promoting RE.

2. Methodology

The policies to be proposed in this study are based on the experiences of promoting RE in different countries around the world. Thus literature review is the most effective way of gathering such information. The same methodology was used in similar studies in the past. Lewis and Wier [13] used the literature review methodology to examine the vital roles of national and sub national policies in providing the support to develop a successful wind turbine manufacturing companies. Cherni and Kentish [16] examined the effectiveness of the RE policy and legislation implemented in China. Mitchell and Connor [17] examined the RE policy in the UK between 1990 and 2003. Applying this method to the current research required extensive study and analysis of the policies currently employed in different countries. A summary of these policies are noted in the following section. Once the proposed polices have been developed they will be discussed with the relevant stakeholders in the UAE, e.g. UAE Ministry of Energy.

The feedback from such discussions will be used to refine the proposed polices.

3. Literature review

In many countries RE already have a significant market share and have developed along different lines in different countries. Different mechanisms have been applied in different countries to promote and encourage the use of RE. Some countries have used the subsidies; others have used the feed in tariff (FIT) system, whereas others used a free market system; these terms are defined and explained in details in the following section. On the other hand, some utilities were forced by their countries to purchase a specific percentage of RE. The development of RE has been supported by the developed countries for the following reasons [1]:

1. To ensure security of supply and to minimize the usage on fossil fuels.
2. To reduce GHG emissions.
3. To improve industrial capabilities.
4. To increase local benefits through creation of jobs and economic development.

RE could be the key to meet the needs of the energy demand of the Earth. However, for the market to move there has to be a demand for the new product through added extra value in terms of comfort or economics, social and environmental benefits. The product must be affordable in relation to income or investment. Additionally, structure of support for the product is also necessary for example information, awareness, maintenance, quality standards, improvement by research and development [6]. Therefore, the introduction of new technologies depends on three things as follows [1]:

- The policy framework shall consider future developments.
- A budget for the new technology shall be available.
- Supportive environment such as capacities for information and awareness.

It is necessary to provide a market foundation which should be ready for the implementation of RE technologies. The market is affected by many factors such as the country conditions, consumer knowledge, and available service [7,8]. Moreover, the public has a role to develop these markets based on specific conditions which differs from each country and region. Lots of work is required to develop markets for green energy in the developing countries. The use of RE in the market is for electricity and heat. These exist in all developing countries, for example in having systems for electricity and fuel markets, while others depend on local markets and the use of direct RE [1].

Most of the successful energy markets depend on the incentives. In developing countries it is important to consider the end uses and work to improve the RE technology, integrating new methods as well as creating new technologies and industries. Moreover, it is important to mention that direct government support is required for new technologies than for incremental advances [1]. Policy experts, government, industry, non-government organizations and academia are considered to be interest in RE policies [9]. Generally, preconditions and preparations are required in the introduction of new technology in an existing market. The policies need to be very effective so that new technologies can overcome barriers and penetrate the market to a significant extent [1]. Table 1 shows the key barriers and policy options for RE in industrialized countries.

One of the most important steps to open the door to RE is deregulation. Deregulation is defined as a change and a restructuring in the electricity regulation market in which electricity is purchased from other providers other than the government. In this section different ways of promoting deregulation and RE policies is discussed. Additionally, how deregulation has affected the RE market, and how the electric utilities have been regulated. Moreover, the advantages and disadvantages of deregulations are analyzed and the process of deregulation development is highlighted. Regulating of electric utilities exists for close to a century. It started in 1907, when New York and Wisconsin became the first states to regulate their electric utilities [10]. The first attempt to deregulate the electricity industry was the Public Utilities Regulatory Policies Act (PURPA) in the USA. It followed the sharp rise in oil prices in the late 1973 and early 1974. The establishment of competition in generation of electric power was being encouraged by PURPA. Additionally, 'qualifying utilities' have been required to allow a connection to the grid. Utilities were required to purchase power produced by the qualifying facilities at avoided costs. The development of small-scale electric power plants was encouraged by PURPA, to provide incentives for RE development. It also made contracts procedure simpler and eliminated complicated procedures and planning problems [11].

Generally, policies that promote the use of RE can make a difference in the market. RE policies concern the stimulation of markets that aims to improve efficiency and reduce cost. Many mechanisms have been implemented to promote the RE market which will be covered within the scope of this paper such as the fixed tariff mechanism, contract bidding mechanisms, tax credits and the quota or Renewable Portfolio Standards (RPS) mechanism. In the last decades, a number of policy instruments for example the green labeling, target setting and procurement policies have been experimented by developed countries. The most important aspects that effect the integration of RE are [1]

- Access;
- Price; and
- contract and policy deregulations.

Many policy mechanisms have been used in the world; the most used mechanism is the fixed tariff mechanism, contract bidding mechanisms and the quota (or RPS) mechanism. The following sections will go through and describe each mechanism separately.

3.1. Feed in Tariff (FIT) mechanism

A tariff is defined as a selling scheme based on a fixed price system to sell the unit; such schemes may focus on quantities or on prices. It guarantees RE generators to be at a fixed price [9]. The U.S. Public Regulatory Policies Act (PURPA) was the first to introduce the FIT policies since the 1970s. PURPA declared guaranteed prices depending on the long term cost of fossil energy (estimated $100 per barrel of oil in 1998). The second implementation of FIT policies was in Denmark and Germany, which was in the mid of 1990, in which the government determined a price for RE and the utilities were required to purchase at that specific price. The FIT is considered as a political price market model, hence the price is being determined by the government and the market determines the quantity [12].

One of the advantages of using the FIT mechanism that it allows the non-traditional developers participate in the RE market, for example the installation of solar panels in households and the owned wind turbines. A disadvantage is that there is no competition in the FIT system; therefore the RE cannot be achieved at the lowest price [12]. It is under the government responsibility to fix a price of the produced electricity from renewable resources. The subsidy can be provided from the government funds or the utility companies may be forced to purchase the electricity

Table 1
Key barriers and policy options for RE in industrialized countries [1].

	Research and development	Demonstration	Diffusion: Early development	Diffusion: Widespread dissemination
Key barriers	• Governments consider R&D funding problematic • Private firms cannot appropriate full benefits of their R&D investments	• Governments consider allocating funds for demonstration projects difficult • Difficult for private sector to capture benefits • Technological risks • High capital costs	• Financing for incremental cost reduction (which can be substantial) • Uncertainties relating to potential for cost reduction • Environmental and other social costs not fully internalized	• Weaknesses in investment, savings and legal institutions and processes • Subsidies to conventional technologies and lack of competition • Prices for competing technologies exclude externalities • Weakness in retail supply, financing and service • Lack of information for consumers and inertia • Environmental and other social costs not fully internalized
Policy options	• Formulating research priorities • Direct public funding • Tax incentives • Technology forcing standards • Stimulating networks and collaborative R&D partnership	• Direct support for demonstration projects • Tax incentives • Low-cost or guaranteed loans • Temporary price guarantees for energy products of demonstration projects	• Temporary subsidies • Tax incentives • Government procurement • Voluntary agreements • Favorable payback tariffs • Competitive market transformation initiatives	• Phasing out subsidies to established energy technologies • Measures to promote competition • Full costing of externalities in energy prices • Green labeling and marketing • Concessions and other market-aggregating mechanisms • Innovative retail financing and consumer credit

produced and sell it to the consumers, thus passing the costs on to the customers [12].

Another advantage of the Feed-in Tariff mechanism is that it reduces the investors risk; hence the generators guarantee a fixed price with a fixed duration, which reduces the risk to investors. Moreover, this mechanism takes the responsibility that once the plant is in operation there will be a fixed guaranteed price for a known period in the future. Tariff mechanisms have been well used in Europe, and have succeeded in many countries for example Spain, Germany and Denmark. However, this mechanism is considered to be unpredictable because even if the prices are fixed to the RE generators, the market plays a role and decides the level of capacity, which means that the number of investors cannot be predictable [13]. FIT mechanisms have been shown to be a strong mechanism in promoting RE resources. Moreover, this mechanism can support the future market stability for investors in long-terms. Spain, Denmark and Germany have been the most successful countries in this field and by using the FIT mechanism; these countries have created stable markets for wind power. Furthermore, the feed-in tariff has also supported the US wind industry in the state of California [13].

3.2. Renewable portfolio standards (RPS) mechanism

RPS is a quota system that requires electricity suppliers to use a certain share of their electricity from RE. The government place a law on the electricity supply companies that a specified amount of electricity shall be from RES; companies which does not meet this law will be forced to pay penalty [12]. This mechanism will create a market with competition between generators; which will result in the best lowest price for renewable electricity. An example of implementing the RPS mechanism is as Special Measures Law in Japan, RPS in 21 US States, as a Renewable Obligation in the UK and as the national MRET in Australia [13]. The RPS is affected by free-market conditions which results in an unregulated technology [12]. In the RPS the price is determined by the market and the quantity established politically. Here the market is the player which decides the source of RE and the price. This means that the RE technology produces power at the lowest cost which is achieved by using advanced technologies and experienced developers. Carbon trading is an example of the RPS policy. Furthermore, in some countries, a cost ceiling is being provided to limit the price of RE sold [14,15].

The price in RPS is not predetermined as it is in the UK case, and the uncertainty on the price and period is expected to limit the participants in the market. It is important to level between the RE and the conventional source; this can be achieved by addressing administrative barriers to allow grid access. It has been revealed that the RPS is the more expensive approach to RE deployment. As mentioned earlier that this mechanism will allow competition, which will lead to a reduction in the costs. In practice, generators are liable to risks, which will have impacts on the capital cost and on the total cost of generation, which will result in high cost for the consumer [13].

3.3. Contract bidding mechanism

Government places an obligation to take electricity from RE technologies on supply companies, which have been awarded contracts by the government. Generally, the lowest bids are

awarded the contract after complying with any criteria set by the government. UK is one of the example which implemented the contract bidding mechanism through the UK Non-Fossil Fuel Obligation (NFFO); another example is Irelands Alternative Energy Requirement (AER) [13]. Many contracts in practice which have been awarded under these mechanisms have failed because these companies consider the bids to cover future cost reductions. Ultimately, policy makers found that this mechanism did not make a manufacturing interest to the country [13].

3.4. Tax credit mechanism

Fiscal instruments have been used to promote the generation of electricity from renewable resources for example lowering the rate applied for RES-E systems. Different tax-related incentives are being provided by many governments to promote the investment in renewable energy. Capital, VAT reductions, tax reductions and property tax incentives are all examples of incentives. In the US federal level the production tax credits was used. Moreover, India's market in the 1990s was also driven by different tax incentives for example 100% redemption of wind equipment was used, another incentive is the 5-year tax holiday. Additionally, China uses tax exemption and VAT on electricity generated from wind. However, unstable markets were the results of the countries that have depended on tax strategies (e.g., US and India) [13].

4. Summary of RE policies from around the world

The history, strategies and polices of promoting RE in different countries were studied in details. This included developed countries such as the USA [13,18], UK [19], Germany [15,20,21], Spain [22–24] and Greece [25,26] as well as India [27] and Cambodia [28].

From the preceding discussions and analysis, it is revealed that RE technologies have been applied in different ways using different mechanisms and strategies in different countries. The discussion could provide important lessons that could help in improving the process of developing policies to promote RE resources. It was shown that the EU has created a good political framework for RE. Moreover, the EU has provided significant research and developed support to the development of RE technologies. A target value was set by the European Conference of RE that 20% of energy consumption to be provided from RES [34]. Moreover, from the experience of the German and Danish cases it is clear that the importance of a fixed-price mechanism in providing long-term security was highlighted. In addition, the FIT guarantees grid access [20].

Table 2 shows the different mechanisms used to promote RE in different countries [20]. The EU has already adopted different strategies to promote electricity from RE sources, which will help finally in providing an incentive for the development of the market [5]. EU countries share a wider policy framework and drivers from the international level, in which they have adopted different RES-E policies. Security of supply, climate change, employment and economic targets were the key measures of success in all countries that have made the first step to integrating RE in their regulation. Different kinds of mechanisms have been used to support the development of RE such as tax exemption, FIT and investment subsidy [19].

In the UK, Denmark and Germany the development of RE does not create a financial burden energy consumers. Moreover, the model of support in Germany and Spain is a simple fixed tariff, which is a low risk profile that enables many wind turbines to be cooperatively owned by local residents [19]. In Denmark, utilities are obligated to purchase electricity that is generated from wind power at 85% of the price paid by customers. From the previous discussion it is shown that feed-in tariff is more efficient than the bidding system. Table 3 shows a compilation comparison between the above case studies showing the different experiences in different countries, the mechanisms used and factors that influence policy decisions. So far, only Germany and Spain provide long-term security for investors with the promotion of RE; this is done through the fixed feed-in tariffs. However, it is required to reduce local resistance against RE projects which occur mainly in Spain. Reference is made to the Global Wind Energy Council Report 2011 which shows the following generated figures from the wind energy. Germany (29,060MW), Spain (21,674MW) which are the considered the leading countries in the wind energy sector, and these countries have applied the feed-in tariffs systems. Moreover India has made a progress in this field as the generated power from the wind energy is (16,084MW) However, there are some countries with feed-in tariffs which are not very successful in the wind energy sector, like Finland (39MW) and Greece (311MW), which shows that success depends on specific construction tools.

Table 2
Instruments for promoting RE [20].

Country	Feed-in tariff	Quota obligation	Tenders	Exemptions from energy taxes	Parts of the revenue of energy taxes finance RES
Austria	•	•	•*		•
Belgium	•*	•			
Denmark	•	○			
Finland	•				
France	•			•	
Germany	•				•
Greece	•				
Ireland			•		
Italy		•			
Luxembourg	•				
Netherlands				•	•
Portugal	•				
Spain	•				
Sweden	•	○		•	
United Kingdom		•			•

•, present promoting system; *, only in one region; and ○, **introduction is planned**.

Table 3
Comparison table between different case studies that implemented RE.

Country	Policy/Mechanism
Spain	• Feed in Tariff (FIT) mechanism
Germany	• Investment subsidies • Feed in Tariff (FIT) mechanism
USA	• Renewable portfolio standard mechanism • The electricity feed law Feed in Tariff (FIT) mechanism • Loan programs
UK	• Non-Fossil Fuel Obligation (NFFO) (contract bidding mechanism) • Simple Fix Tariff (Feed in Tariff (FIT) mechanism)
India	• Loan programs • Private investment (incentives)
Greece	• Tax deduction for renewable and natural gas (tax credit mechanism)
Cambodia	• The electricity law (Tariff) • Renewable electricity action plan (REAP) • A loan program

There are several reasons for the success of countries using feed-in tariffs like Germany and Spain. In the case of Germany, the reason was that the German feed-in law offers investors long-term security through guaranteed and fixed tariffs for a period of 20 years. Additionally, the successes of the German promotion system were because of strong financial subsidy programs such as the 100,000 Roofs Photovoltaic Program. In Spain two tariff options for promoting RE is available. One is based on a guaranteed fixed tariff which is updated annually, while the other is a market rated tariff, which makes consumers pay the suppliers an equivalent rate of the electricity market price. Both options are being modified and updated annually by the government. In comparison to the German system, the Spanish provides less investor security. On the other hand, Greece uses a feed in tariff system with guaranteed purchase contracts for a period of 10 years including a renewal option. The Netherlands uses the tax advantage system, however, security and regulations have not been stabilized. Fig. 1 shows the factors which influence the RE development in EU countries and other countries in general [20].

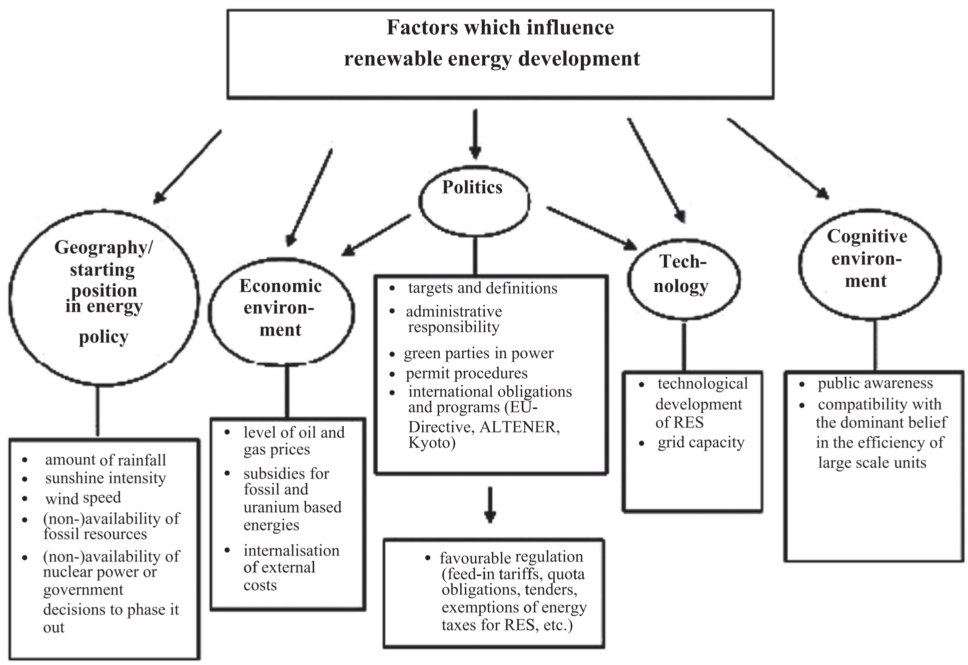


Fig. 1. Factors which influence the RE development in EU countries and other countries in general [20].

Table 4
Short-term policies for promoting RE in the UAE (time frame 1–5 years).

Policy term	Experience gained from	Action to be taken by
Renewable energy policy	All developed countries	• Dubai government • DEWA
Soft loan	Spain/Germany/USA/India/Cambodia	• Dubai government • Local banks
Deregulation at emirate level (Dubai)	USA (PURPA) require utilities to buy electricity from RES	• Dubai government
Financial incentives	Denmark/Germany/The Netherlands/India	• Dubai Government • DEWA
The use of domestic solar water heaters[a]	Spain/Greece/Austria	• Dubai municipality (building permit) • JAFZA building (building permit)
Tax deduction for custom	Greece	• Federal government • Dubai government
Grid access (5%)	Spain/Germany	• Dubai government • DEWA
Renewable energy certificates (RECs)	USA (Connecticut, Pennsylvania and Nevada)	• Dubai government • Dubai carbon center • Dubai supreme council of energy

[a] Has since been made mandatory in Dubai Municipality's revised building regulation (2012)

5. Proposed policies for the UAE

In addition to the lessons learnt from other countries as addressed above in the summary of RE policies from around the world, it is important to identify the limitations that stand in the way of promoting RE in the UAE. Although the UAE has sufficient solar resources for electricity exploitation, but the RE resource area is considered a limitation its self. The main limitations are:

- The electricity industry is controlled individually by each of the 7 emirates. This leads to defragmentation and some discrepancies in the regulations between the different emirates.
- The low cost of electricity mainly due to large government subsidies, e.g. the cost of electricity in the emirate of Abu Dhabi is approximately 4 US cents per kWh.
- No provisions for feed-back of excess power back into the electricity grid.
- No direct taxation system that can be used to incentivize the use or RE.
- High income rate thus resulting in less "need" to electricity.
- Transparency of regulations.
- Provisions to allow and control private–public cooperation and independent power providers.
- No regulations or requirements for mandatory use of RE.

Given the limitations above, a roadmap of policies was proposed for short (1–5 years), medium (5–10 years) and long term (10+ years) designed to address these limitations and promote the use or RE in the UAE. The initial proposal was then discussed with four senior managers in some of the stakeholders including Dubai Electricity and Water Authority (DEWA) and the Ministry of Energy. The proposed roadmap was welcomed by all the stakeholders interviewed. Some of the suggestions raised by the stakeholders were taken into consideration and the observations were also underscored at these meetings. Examples of the suggestion include the assignment of ministry of energy which will be responsible for all the decisions and which will coordinate with other authorities. Another suggestion was to the proposal of the roadmap. The proposed roadmap was then refined based on the feedback from those meetings. The final roadmap for promoting the use of RES is shown in Tables 4–6. In each case the country (ies) each policy term was fashioned after is shown. The UAE organization which should implement the proposed policy is also shown in the same tables.

Table 5
Medium-term policies for promoting RE in the UAE (time frame 5–10 years).

Policy term	Experience gained from	Action to be taken by
Deregulation at country level (UAE)	USA	• Federal government
Feed-in-tariff	Spain/Germany/US/UK/Cambodia	• Federal government • DEWA
Improve the grid access for RES (10%)	Spain/Germany	• Federal government
Quota obligations (2%)	USA	• Federal government
Carbon tax-charge tax on fossil fuels for future	UK (NFFO) India/Renewable obligations	• DEWA • Federal government

Table 6
Long-term policies for promoting RE in the UAE (time frame 10+ years).

Policy term	Experience gained from	Action to be taken by
Deregulation at GCC level	USA	• GCC countries members • Government
Feed-in-tariff	Spain/Germany US/UK/Cambodia	• DEWA • Federal ministry of energy • Federal government
Mandatory use of RES 5% target by 2020	Spain/Germany	• Federal government • The supreme council of energy
Quota obligation 10%	UK	• Federal government • Dubai supreme council of energy

6. Conclusions

The continued expansion of RE in the electricity industry has been, and remains, a key government objective. It is essential to define the future role of the different sources of energy and to outline the required steps to move into a sustainable future energy system. This paper has looked into the UAE current strategies as well as its future plans and targets. It has been revealed that UAE needs a policy to unlock the RE market and to start to develop in the RE sector. Moreover, one of the primary goals is to make this research as a valuable reference for energy policy makers and planners on national and in international levels to achieve environmentally sustainable power development.

Different experiences and lessons from the leading countries in the RE technology sector have been considered to develop a policy draft that matches with the UAE conditions and status to achieve an effective implementation of RE. In this paper, we were able to prepare a policy that considered feedbacks from experts and stakeholders in this field and has been revised as per their comments to provide a RE policy applicable to the UAE. Moreover, the prepared policy has been set to be achieved in three stages; short, medium and long terms to be able to implement RE policies in the country gradually. The system proposed here is considered to be technically and environmentally feasible and could meet the near environmental objectives. It has been concluded that the UAE is able to apply RE policies and that it requires strong and continued political commitment to support this move. Additionally, the need for integrated government policy making is important. One of the main policy terms was to assign a ministry to the development of RE. Other important policies were as a start for a deregulation and combination of financial incentives, soft loans connected to allowance to connect to the grid. The outcome of this study was the proposed policy which contained the applicable policy terms which can be applied in the UAE and in different stages as follows:

- Short term policy included but is not limited to a deregulation plan on emirate level, soft loans to be provided for investors and customers, RE grid access and the use of Domestic Solar Water Heater (DSWH).
- Medium term policy included but is not limited to a deregulation plan on country level, improvement of grid access to 10%.
- Long term policy included but is not limited to deregulation on Gulf level and introduction to Feed in Tariff policy.

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